An Introduction to Some Common Natural Enemies of Insect/Mite Pests in Colorado
Natural Controls

Natural Enemies

Abiotic (Weather) Controls

Topographic Limitations
Natural Enemies

• Predators
• Parasitoids
• Pathogens
Recognize so you can work with (and avoid working against) existing natural controls

*Life Styles of the Swift and Vicious*
Characteristics of Insect Predators

- Immature stages actively hunt prey
- Several prey are consumed in the course of development
- Adults may or may not have similar food needs as immature form
Some Common Arthropod Predators

- Lady beetles
- Ground beetles
- Lacewings
- Flower flies
- Robber flies
- Mantids
- Assassin bugs
- Predatory stink bugs
- Minute pirate bugs
- Predatory thrips
- Predatory mites
- All spiders
a.k.a. “ladybug”, “ladybird”
Most lady beetle adults are brightly colored.
Pinkspotted lady beetle
Coleomegilla maculata

A species that feeds mostly on eggs and larvae of beetles
LeConte’s giant lady beetle
*Anatis lecontei*

A species that feeds on aphids and mealybugs on trees
Upper left: *Coccidophilus*, a scale predator

Lower left: *Olla* sp., a grey colored lady beetle of forests

Below: *Chilochorus* sp., a predator of various scales
The “bad apple” of the lady beetle clan
Life cycle of the Mexican bean beetle

Adult
Eggs
Larva
Pupa
Lady Beetle Life Stages

- Adults
- Eggs
- Larvae
- Pupae
Lady beetles lay masses of eggs near sources of food for their young.
Lady beetles with egg masses
Lady beetle larvae at egg hatch
Lady beetle larvae

Predators of small soft-bodied arthropods (aphids etc...)
Some odd looking lady beetle larvae

"Woolly" looking larvae that feed on scale insects

Spider mite specialists are tiny
Lady beetle prepupae
Lady beetle pupae
Stages of a newly molted convergent lady beetle
LADYBIRDS DO THE WORK...

No More Poison Sprays

Use the safe biological method used by government and large growers to destroy aphids, inchworms, Japanese beetles, fruit scales, leafhoppers, boll worms, corn ear worms, mites, etc. Ladybugs (ladybird beetles) live on larvae, eggs and insect pests. About 9000 Ladybugs to the pint. Instructions.

A000455E...Ladybugs (½ pint) .............. $9.95
A000463E...Ladybugs (1 pint) ............ $15.95

Purchasing lady beetles?
Convergent lady beetle
(*Hippodamia convergens*)
– the lady beetle of commerce
Unlike most lady beetles, the convergent lady beetle often masses during the dormant period.
Massed lady beetles in the Sierra Nevada Mountains

Photograph courtesy of James Solomon USDA-FS
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Purchasing lady beetles?
Lady beetle releases are fun.
Conserve and enhance existing lady beetles
Conserving and Enhancing Natural Enemies

- Don’t kill them
  - Limit use of broad spectrum insecticides
- Provide foods that the adults need
  - Often need nectar, pollen
- Provide foods that the immature stages need
  - Allow there to be some hosts, prey available
Principles of Gardening for Natural Enemies of Insect Pests

- Learn to recognize them – and don’t kill them
  - Provide for food needs of adults
  - Provide for food needs of immature stages
  - Provide nest sites, if required
Lady Beetle Larvae
Principles of Gardening for Natural Enemies of Insect Pests

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Lady beetle adults feed on nectar and pollen
Adults of many predators use flowers (nectar, pollen) for sustenance.
Small, accessible flowers are most commonly used by natural enemies of garden pest insects.
Some plants useful for providing food for adult stages of insect predators and parasites

- Most Apiaceae - (dill, fennel, mooncarrot, etc.)
- Yarrow
- Many sedums
- Spurges
- Alyssum
- Basket-of-gold
- Thyme, several herbs
My new favorite plant

*Ammi* (false Queen Anne’s lace)
Promote habitat diversity to optimize natural enemies
Cilantro and dill purposefully planted to supply food needs for natural enemies of aphids in a greenhouse.
Principles of Gardening for Insect Natural Enemies

- Learn to recognize them – and don’t kill them
- Provide for food needs of adults

Provide for food needs of immature stages

- Provide nest sites, if required
Spirea aphids on my bridal wreath spirea shrub – a pest??
Perennial plants that consistently provide predator food sources in my garden
An excellent publication by the Xerces Society on this subject
Green Lacewings
Neuroptera: Chrysopidae
Adult green lacewings sustain themselves on nectar and pollen.
**Lacewing Adult [x3]**
Feeds on honeydews, nectars, and pollens. Lives 20-40 days. Each female 10-30 eggs per day.

**GREEN LACEWING LIFE CYCLE**

**Cocoon [x3]**

**Lacewing larvae [x7]**
General predator: Aphids, psyllids, mealy bugs, moth eggs and larvae, etc.

**Eggs [x5]**

10 days

12 days

5 days
Green lacewing eggs are uniquely stalked
Green lacewing eggs often are laid in groups. Egg hatch has occurred in the lower picture.
Green Lacewing Larvae

Photograph courtesy of Brian Valentine

Photograph courtesy of David Shetlar
Left: Green lacewing larva eating aphid

Right: Green lacewing larva eating leaf beetle larva
Green lacewing eggs are available from many suppliers that rear/distribute insects.
Flower (Syrphid) Flies
a.k.a. “flower flies”, “hover flies”
CAUTION

Insect Mimicry in Action!
Syrphid flies are excellent mimics of bees and wasps.
Honey Bee ...or Flower Fly?
Syrphid fly eggs are typically laid in an aphid colony.
Flower fly larvae
Predatory Hemiptera

- Predatory stink bugs
- Assassin bugs
- Damsel bugs
- Minute pirate bugs
- Big-eyed bugs
- Predatory plant bugs
Some generalist hemipteran predators

Damsel bug

Spined assassin bug

Chlamydatum associatus

Minute pirate bugs
Assassin Bugs

Hemiptera: Reduviidae
An Assassin Bug
- *Zelus luridus*

- Adult
- Nymph feeding on wasp
- Egg mass and nymph
- Nymph feeding on wasp
Wheel Bug (*Arilus cristatus*)

Largest regional assassin bug

Photograph by Jim Kalisch, University of Nebraska

Photograph by Susan Ellis
Predatory Stink Bugs

Hemiptera: Pentatomidae
Stink bugs with prey
Minute pirate bugs

Hemiptera: Anthocoridae

Photograph courtesy of University of California IPM Program
Feeding on a thrips

Feeding on a small caterpillar

Nymph feeding on an aphid

Adult feeding on spider mite eggs
Thrips are the most important food item for building healthy populations of minute pirate bugs.
Order Mantodea
Mantids
European Mantid
*Mantis religiosa*
European mantid – Armpit “bullseye”
European mantid life stages
European mantid egg cases
Some native mantids found in eastern Colorado
Carolina Mantid

*Stagmomantis carolina*

Eastern Colorado Native

Photograph courtesy of Jim Kalisch
Chinese Mantid

Tenodera sinensis
Egg cases of the Chinese mantid are sold by some nurseries and in some garden catalogs.
Some newly hatched nymphs

Egg case (ootheca)

Chinese mantid

Nymph feeding on grasshopper

Adult
I hope not!!
European mantid mating pair, 2:30 PM, Mon. Sept. 29, 2008.
European mantid male as lunch, 4:00 PM, Mon. Sept. 29, 2008.
Spiders

Order Araneae
All Spiders are Predators
Some spiders use webbing to snare prey
Orb-weaver Spiders

Family Araneidae
Argiope species
Banded garden spider
(Whiteback garden spider)

*Argiope trifasciata*
Some spiders hunt prey without the aid of silk
Crab spiders
Characteristics of Insect Parasitoids

- Larvae develop in, rarely on, their hosts
  - One or more larvae develop in a single host
- They are invariably lethal to the host
  - “parasitoids”
- Adults often have different food needs
  - Nectar, honeydew
  - Pollen
  - Insect blood feeding may occur
Common Insect Parasitoids

• Parasitic Hymenoptera
  – Braconid wasps
  – Ichneumonid wasps
  – Chalcid wasps
  – Eulophid wasp
  – Trichogrammatid wasps

• Parasitic Diptera
  – Tachinid flies
Parasitic (Parasitoid) Wasps

Ichneumonidae, Braconidae, Eulophidae, Trichogrammatidae, Encrytidae, Chalcidae and other families
Parasitic wasps sustain themselves on nectar and pollen.
Females possess an ovipositor that may be prominent.

These wasps do not sting.
Parasitic Wasps – Male (left) and Female (right)
Ectoparasitic wasp larvae on fall webworm caterpillar host
Parasitoid larvae emerging from caterpillar host
Parasitoid larvae (*Cotesia glomeratus*) emerging from cabbageworm host and spinning pupal cocoons
Cocoons of the cabbageworm parasitoid (*Cotesia glomeratus*)
Some parasitoids pupate on the insect host

Left: Buck moth caterpillar
Below: Tobacco hornworm
Giant Ichneumon Wasp, Parasitoid of the Pigeon Tremex Horntail
Pigeon tremex – a wood boring wasp of deciduous trees in decline
Giant ichneumon wasp – the largest parasitoid wasp of the region

Photographs courtesy of Mark MacMillan
Egg parasitoids
Trichogramma wasps, a type of egg parasitoid
Aphid parasitoids
Photographs courtesy of Brian Valentine

Host evaluation

Oviposition
Aphid Mummies

Aphid showing early symptoms of parasitism
Parasitized psyllids (above) and soft scale (below)

Parasitized aphids (above) and whiteflies (black forms, below)
Tachinid Flies
Tachinid fly eggs on body of whitelined sphinx caterpillar. Some are indicated with arrows.
Tachinid fly eggs on caterpillar (above), squash bugs (upper right) and Japanese beetle (right)
Hatched egg

Opening for spiracle of tachinid fly larva
Cabbage looper supporting six developing tachinid fly larvae

Tachinid fly pupae within killed cabbage looper larva
Caterpillars killed by tachinid flies

Photograph courtesy of Ken Gray/Oregon State University
Pupa of now dead host

Tachinid fly pupa
Tachinid fly adults sustain themselves on nectar and pollen
Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

*Istocheta aldrichi* – tachinid fly parasitoid of Japanese beetle adults

Note: Success of this natural enemy usually tracks with the nearby availability of suitable flowering plants in July.
Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

*Tiphia* wasps – parasitic wasps (2 species) of Japanese beetle larvae

*Note:* Success of this natural enemy usually tracks with availability of suitable flowering plants in late April-May.
Hunting Wasps
Families Sphecidae, Crabronidae, Pompilidae
Ammophila wasp digging nest (left), carrying caterpillar prey (lower left), at nest entrance with prey (below)
Bembix wasp digging while holding horse fly prey
*Bicyrtes quadrifasciatus* – a hunting wasp that nests in sandy soils

Stink bugs and leaffooted bugs are prey for this insect
Golden Digger Wasp – Predator of longhorned grasshoppers/katydid
Cicada Killers – Largest hunting wasps
Pemphredon wasps nest in plant stems and hunt small insects
Pemphredon wasps nest in plant stems and hunt small insects
Condominium Project for Pith Nesting Pempredon Wasps
An excellent publication by the Xerces Society
This presentation will be posted at the Insect Information Web Site

- **Housed at Department of Bioagricultural Sciences and Pest Management**
  - Search BSPM CSU
- **Within Extension and Outreach**
- **Insect Information**
  - Extension presentations for 2018 posted at bottom of page
Insect Information

All materials needed in another accessible format can be made available upon request.

Arthropods of Colorado Fact Sheets
This is a listing of about 200 downloadable fact sheets related to insects and other "bugs" found in Colorado. It contains fact sheets that are written for the Colorado Arthropods of Interest series and the Extension fact sheets that are related to insects.

Some Entomology Hot Links:
- Colorado Hemp Insect Website
- Western Colorado Entomology Website
- IPM Images/Bugwood (Cranshaw)
- IPM Images/Bugwood (Peairs)
- Entomology Resources List
- Honey Bee Swarm Hotlines

Miscellaneous Insect Information
Click Here for the powerpoint shown today
Garden Insects of North America, 2nd Edition

• Complete revision of original
• Co-authored (with David Shetlar, Ohio State University)
• Contains over 3100 photos, most all new
• Retail price $35